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(54) **ADJUSTABLE AIRFLOW CARTRIDGE FOR ELECTRONIC VAPORIZER**

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(51) **Int. Cl.**

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A24F 40/42	(2020.01)
A24F 40/46	(2020.01)
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(Continued)

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CPC ***A24F 40/485*** (2020.01); ***A24F 7/00*** (2013.01); ***A24F 40/10*** (2020.01); ***A24F 40/42*** (2020.01); ***A24F 40/46*** (2020.01); ***A24F 40/60*** (2020.01); ***H05B 3/18*** (2013.01); *H05B 2203/021* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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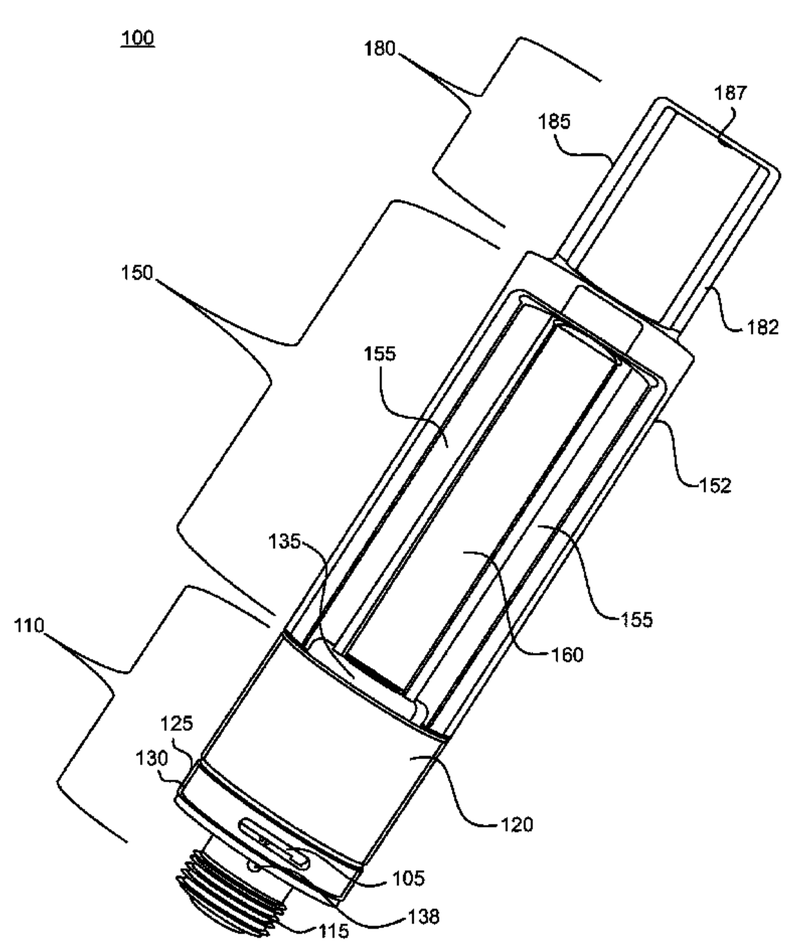
(57) **ABSTRACT**

An adjustable airflow cartridge for vaporizing liquids is provided herein featuring a top section including a mouthpiece, a middle section including a tank, a bottom section including a heating element and at least one adjustable intake air aperture, a tube extending from the bottom section through the tank to the mouthpiece, and a rotatable portion on the bottom section that when rotated is configured to increase or decrease a size of at least one adjustable intake air aperture. Air may flow through the adjustable airflow cartridge from the bottom section to the top section by flowing through at least one adjustable intake air aperture, through the heating element, and through the tube to the mouthpiece. In addition, the amount of air that may flow through the at least one adjustable intake air aperture may be adjusted based upon a rotation of the rotatable portion by a user.

9 Claims, 5 Drawing Sheets



(51) **Int. Cl.**
H05B 3/18 (2006.01)
A24F 7/00 (2006.01)

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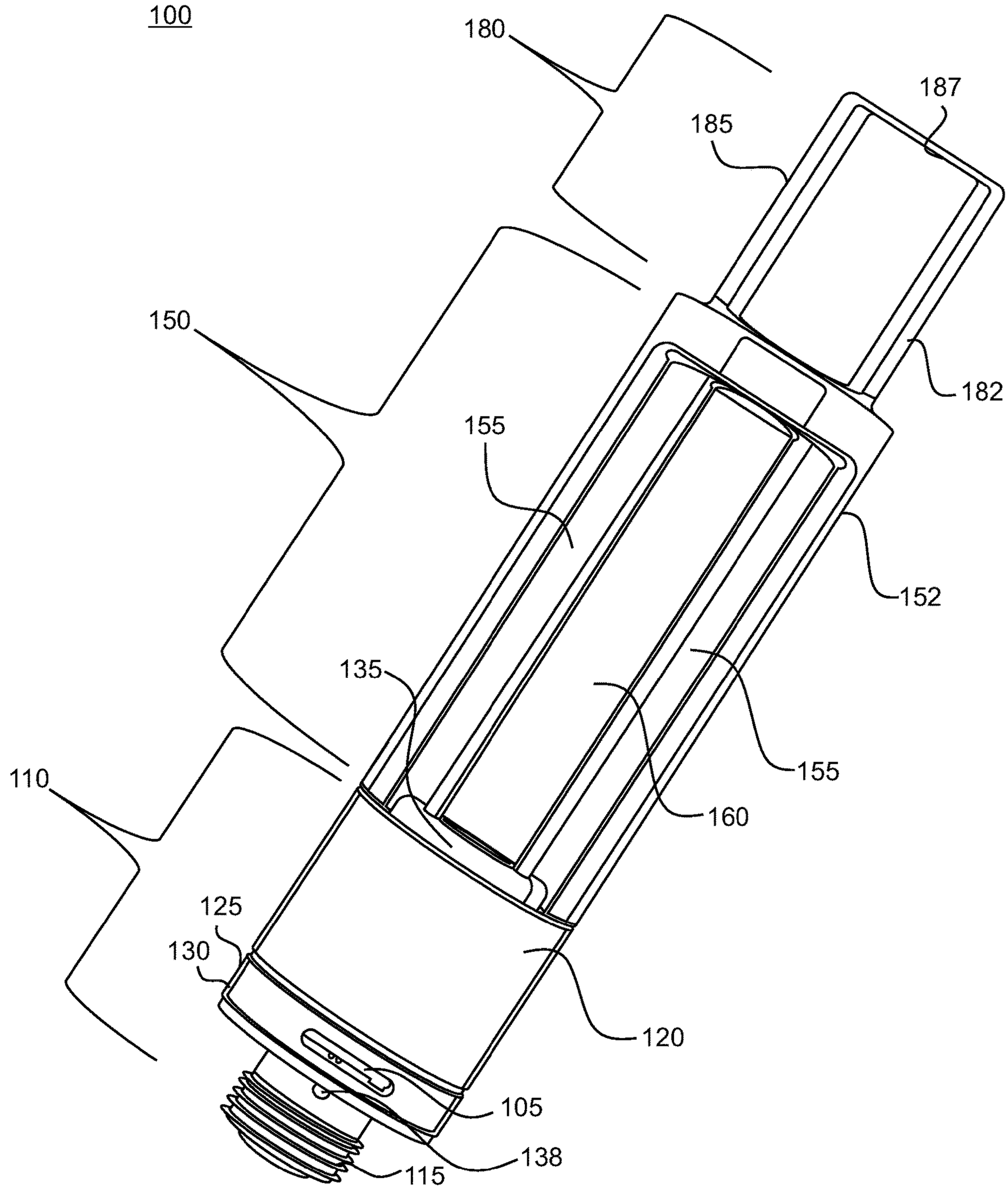
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FIG. 1

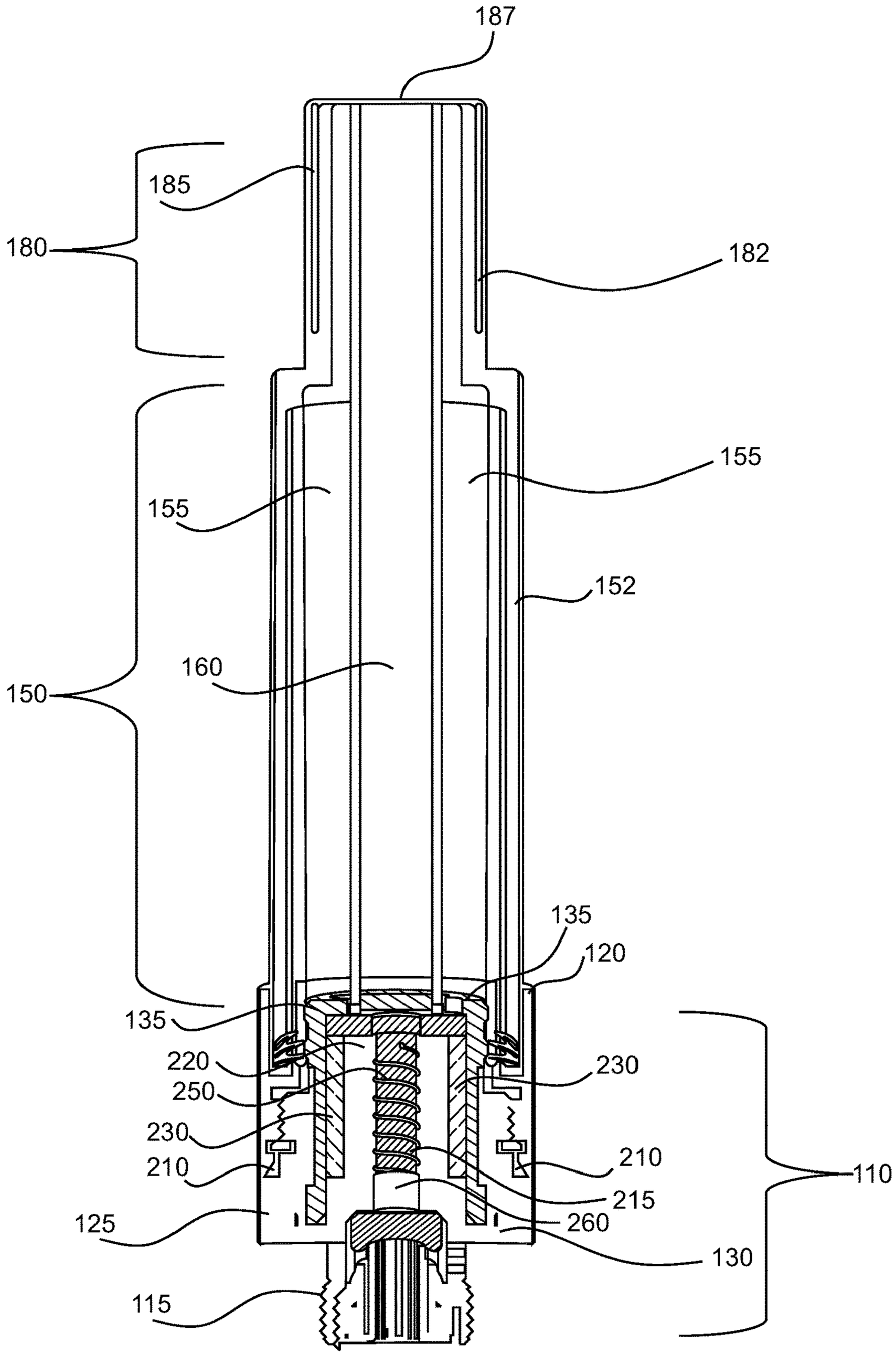
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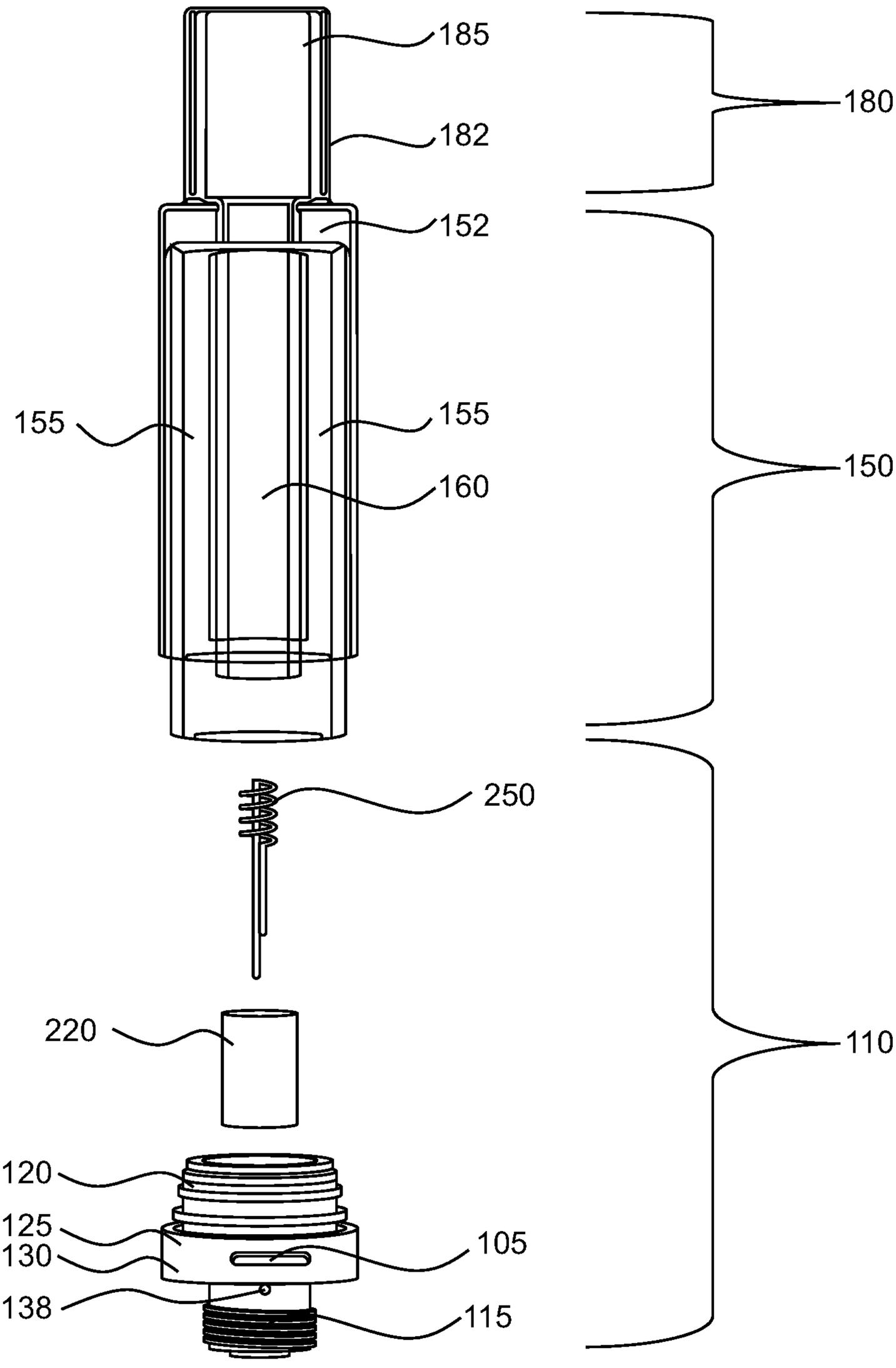
FIG. 2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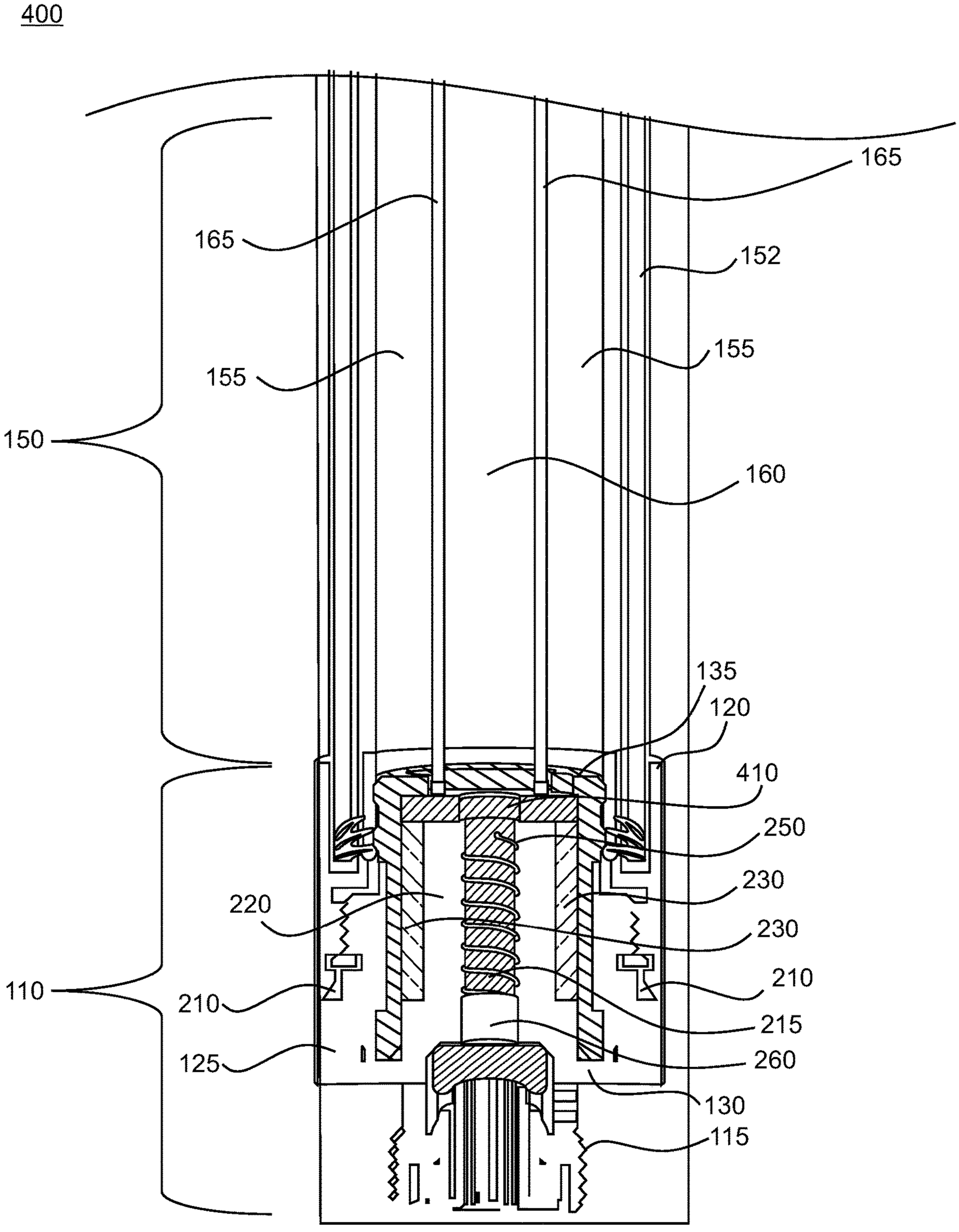
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FIG. 4

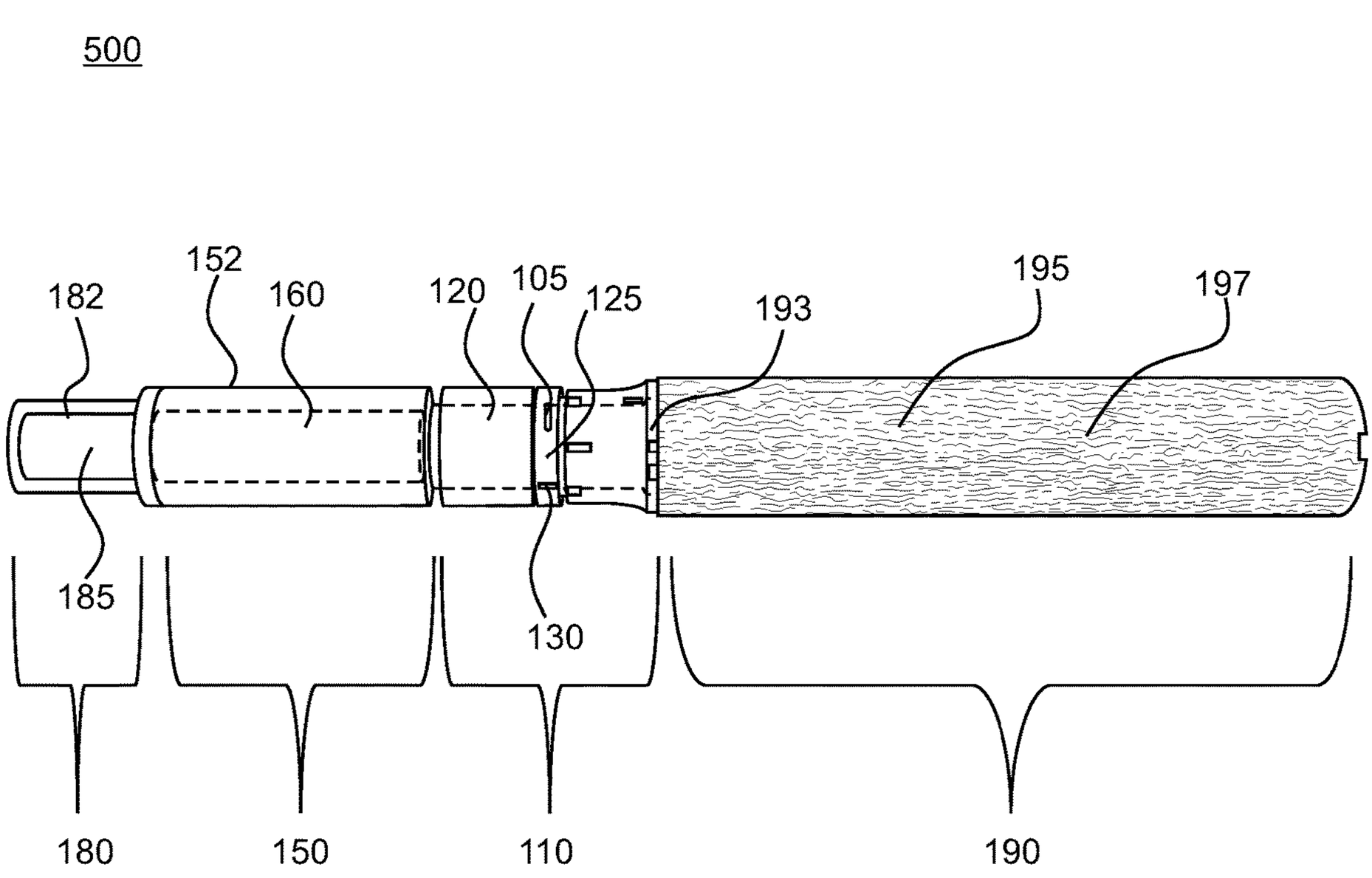

FIG. 5

ADJUSTABLE AIRFLOW CARTRIDGE FOR ELECTRONIC VAPORIZER

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application No. 63/064,797, filed on Aug. 12, 2020, which is incorporated by reference as if fully set forth.

FIELD OF INVENTION

The present invention relates to electronic vaporizers, and more particularly to adjustable airflow cartridges configured for use within electronic vaporizers.

BACKGROUND

Cartridges for holding liquids and vape oils within electronic vaporizers are known in the art. Currently on the market, some cartridges provide a limited range of airflow to a user, thereby restricting the vaping experience and customizability relative to user preferences for high or low viscosity oils, flavor and vapor cloud production. Accordingly, there is a need for a cartridge that offers variability in the airflow by providing additional functionality to allow a user to determine the optimal amount of air that passes through the cartridge when the user draws air through the cartridge via the mouthpiece of the cartridge. Such functionality may enhance a user's experience with an electronic vaporizer by providing optionality relative to adjusting the size of one or more adjustable intake air apertures based upon the configuration of the cartridge.

SUMMARY

There is provided according to the embodiments of the invention an adjustable airflow cartridge for vaporizing liquids comprising a top section including a mouthpiece, a middle section including a tank, a bottom section including a heating element and at least one adjustable intake air aperture, a tube extending from the bottom section through the tank to the mouthpiece, and a rotatable portion on the bottom section that when rotated is configured to increase or decrease a size of the at least one adjustable intake air aperture. Air may flow through the adjustable airflow cartridge from the bottom section to the top section by flowing through at least one adjustable intake air aperture, through the heating element, and through the tube to the mouthpiece. In addition, an amount of air that may flow through at least one adjustable intake air aperture may be adjusted based upon a rotation of the rotatable portion by a user.

In an embodiment, the adjustable airflow cartridge of the embodiments described herein may also provide for faster vaporization with maximum vapor and purer taste based upon the location of the atomizer with respect to ceramic glazed wires.

In another embodiment, the adjustable airflow cartridge may feature a porous ceramic heating element that may enable the adjustable airflow cartridge to vaporize liquids and oils at lower temperatures to provide for enhanced flavors and cleaner tasting terpene profiles of the liquids and oils.

In another embodiment, the structure of the adjustable airflow cartridge may create a larger surface area of a microporous ceramic material contributing to enhance the taste and flavor for the user during vaping.

In yet another embodiment, the heating element may include an embedded coil that is surrounded by a particular ceramic material that may provide protection for the oil or resin within the cartridge that is heated for vaping.

In an embodiment, one or more adjustable intake air apertures in the metallic housing of the bottom section of the cartridge may provide a customizable airflow to a user.

In another embodiment, a portion of the bottom section of the cartridge including an adjustable air flow collar comprising one or more adjustable intake air apertures may be rotated or twisted by a user to adjust the airflow through the one or more adjustable intake air apertures.

In another embodiment, the cartridge including one or more adjustable intake air apertures may feature a slidable collar that a user may slide up and down the exterior housing of the cartridge to increase or decrease the size of the one or more adjustable intake air apertures.

In yet another embodiment, the cartridge including one or more adjustable intake air apertures may feature a lever that rotates a cover for the one or more adjustable intake air apertures, thereby increasing or decreasing the size of the one or more adjustable intake air apertures.

These and other objects, features and advantages will be apparent from the following detailed description of illustrative embodiments thereof, which is to be read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

A more detailed understanding may be had from the following description, given by way of example in conjunction with the accompanying drawings herein.

FIG. **1** shows a perspective view of an adjustable airflow cartridge of the herein described embodiments.

FIG. **2** shows a perspective view of an adjustable airflow cartridge with a heating element with porous ceramic material.

FIG. **3** shows an exploded view of an example adjustable airflow cartridge featuring a heating element with porous ceramic material of the herein described embodiments.

FIG. **4** shows a cross-sectional view of an adjustable airflow cartridge with ceramic heating element and ceramic protector.

FIG. **5** shows a perspective view of an adjustable airflow cartridge of the herein described embodiments that is coupled to a vaporizer pen.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Various embodiments are described herein where like references to figures are used to describe like features. Each feature or element may be used alone without other features and elements or in various combinations with or without other features and elements.

The present embodiments relate to an adjustable airflow cartridge for use within electronic vaporizers. In general, a vaporizer device utilizes a battery that powers the heating device or atomizer, which vaporizes a liquid held inside a cartridge. Cartridges for electronic vaporizers are utilized for holding liquids and vape oils that are heated by the adjacent atomizer to produce vapors within the airway leading to the mouthpiece of the electronic vaporizer. The cartridge may be coupled to the battery of an electronic vaporizer by screwing the cartridge into the battery with 510 threading, for example.

Liquid from the cartridge flows to the atomizer, which is vaporized at a temperature level, determined, in part, by the voltage from the battery. When a user applies suction to the mouthpiece of the vaporizer, air moves into the cartridge through an adjustable air intake aperture located at the bottom section of the cartridge. At a point when a user draws air through the mouthpiece, air may pass through one or more adjustable intake air apertures, through the cartridge to the mouthpiece. A vaporizer generally utilizes convection heating to heat the air within the cartridge to a certain temperature; when the heated air passes through the liquid, the liquid is vaporized. Particular liquids and vape oils may be added to the cartridge based upon user preferences, such as flavor and vaporization properties.

The cartridge may feature a housing that may be made of quartz glass, where the housing encases both a top section comprising a mouthpiece and a middle section including a tank for maintaining a liquid or vape oil. In addition, the cartridge may further include a center tube that may be made of quartz glass. The center tube may extend through the tank to provide an airway extending from the mouthpiece to a bottom section of the cartridge.

The bottom section of the cartridge may feature a housing that adjoins the housing of the middle section. The housing of the bottom section may be metallic and may also feature an adjustable air flow collar comprising one or more adjustable intake air apertures that provides air intake through the housing of the bottom section. When a user draws air through the mouthpiece, air may pass through the one or more adjustable intake air apertures, through the atomizer and liquid or vape oil, and then through the center tube to the mouthpiece. The adjustable air flow collar comprising the one or more adjustable intake air apertures may be positioned adjacent to 510 threading on the housing of the bottom section, where the 510 threading may be utilized for screwing the cartridge into a battery. The interior of the bottom section may include a heating element with porous ceramic material, where the heating element may comprise a heat resistant wire such as a Kanthal® wire embedded in a porous ceramic material.

The adjustable air flow collar, comprising the one or more adjustable intake air apertures in the housing of the bottom section of the cartridge, may provide a customizable airflow to a user. In an embodiment, a portion of the bottom section including the adjustable air flow collar comprising one or more adjustable intake air apertures may be rotated or twisted by a user to adjust the airflow through the one or more adjustable intake air apertures. In another embodiment, the cartridge may feature a slidable collar that a user may slide up and down the exterior housing of the cartridge to increase or decrease the size of the adjustable intake air apertures. In yet another embodiment, the cartridge may feature a lever that rotates a cover for the adjustable intake air apertures, thereby increasing or decreasing the size of the one or more adjustable intake air apertures.

In general, the level of airflow between the one or more adjustable intake air apertures of the bottom section of the cartridge and the mouthpiece of the top section of the cartridge may determine the user's experience with an electronic vaporizer. A user's preference in the range of airflow through an adjustable intake air aperture of the bottom section may depend, in part, upon whether the oil within the tank is a high or low viscosity oil, whether the user desires more or less flavor from a particular oil or liquid, or if more vapor production is desired. By altering the airflow through the one or more adjustable intake air apertures of the bottom section, a user's experience may be customized. For example, to enhance vapor production while moderating the flavor, a user may twist or rotate the portion of the bottom section featuring the adjustable air flow collar comprising the one or more adjustable intake air apertures to increase the airflow through the one or more adjustable intake air apertures. Likewise, to reduce vapor production while enhancing the flavor, a user may twist or rotate the portion of the bottom section featuring the adjustable air flow collar comprising the one or more adjustable intake air apertures to decrease the airflow through the one or more adjustable intake air apertures.

In particular, a user may twist or rotate the adjustable air flow collar comprising the one or more adjustable intake air apertures so that the size of the one or more air apertures reciprocally adjusts between larger apertures providing increased airflow and smaller apertures providing decreased airflow. As such, the adjustable airflow cartridge may provide flexibility and customizability by enabling a user to selectively determine a desired airflow, based upon the ability to reciprocally adjust between sizes of the one or more adjustable intake air apertures within the metallic housing of the bottom section of the cartridge.

As aforementioned, the top and middle sections of the adjustable airflow cartridge may feature a quartz glass housing, while the bottom section with one or more adjustable intake air apertures and 510 threading may feature a metallic exterior. In an embodiment in which the whole tank of the middle section, including both the quartz glass housing and quartz glass center tube, is comprised of glass, metal elements do not contact the liquid or vape oil within the cartridge.

Metallic portions of the adjustable airflow cartridge may comprise a ceramic coating featuring a range of thickness of 1-2 microns. The ceramic coating may provide protection against heavy metals within the components of the cartridge from absorbing into the vapors during vaporization of liquids and oils within the cartridge. In an embodiment in which the top and middle sections also feature a metallic structure, it is understood that a ceramic coating on such top and middle sections may also provide protection against heavy metals absorbing into the vapors during vaporization of liquids and oils within the cartridge.

In other embodiments, the range of thickness of the ceramic coating over metallic portions of the adjustable airflow cartridge may be larger than 1-2 microns, or it may be smaller than 1-2 microns.

The ceramic coating of the embodiments described herein may also comprise a zirconium nitride coating. In one embodiment, the metal components of the cartridge may be exclusively coated in a layer of zirconium nitride.

The adjustable airflow cartridge of the embodiments described herein may also provide for faster heating of the liquids and vape oils within the cartridge, enhanced vapor volume and improved taste for the user. The ceramic heating element comprising porous ceramic material may also accommodate the properties of the liquids and vape oils within the cartridge, so that the cartridge is suitable for CBD/THC/or essential oil quantities.

The structure of the adjustable airflow cartridge described herein may also provide for an improved vaping experience in terms of the time required to produce a quality vapor and the flavor of the vapor.

The adjustable airflow cartridge herein provides for improved customization of a user's experience with an electronic vaporizer based upon the determination of the airflow through one or more adjustable intake air apertures of the cartridge. Further, the adjustable airflow cartridge

described herein may also feature structural features that provide for an enhanced vape experience in terms of safety, flavor and heating and vaping efficiency.

FIG. **1** shows an example embodiment of an adjustable airflow cartridge **100**. The adjustable airflow cartridge **100** shown in FIG. **1** is oriented diagonally and may feature a bottom section **110** with at least one adjustable intake air aperture **105** and 510 threading **115** for screwing the adjustable airflow cartridge **100** into a battery. The bottom section **110** may further include a heating element with porous ceramic material, where the heating element may comprise a heat resistant wire, such as a Kanthal® wire embedded in the porous ceramic material.

Referring again to FIG. **1**, the adjustable airflow cartridge **100** may further include a middle section **150** including a tank **155** for holding a liquid or vape oil. A center tube **160**, that may be comprised of quartz glass, may extend through the tank **155** to provide an airway from the bottom section **110** of the adjustable airflow adjustable airflow cartridge **100** to a mouthpiece **185** with opening **187** at the top section **180** of the cartridge. Because the center tube **160** may extend through the tank **155** of the middle section **150**, the perspective view of FIG. **1** illustrates the tank **155** on either side of the center tube **160** that extends through the tank **155**.

As further shown in FIG. **1**, each of the top **180** and middle **150** sections of the adjustable airflow cartridge **100** may feature a respective housing **182**, **152** that may be made of quartz glass. The housing **182** of the top section **180** may extend to and adjoin the housing **152** of the middle section **150**. In addition, the housing **152** of the middle section **150** may extend to and adjoin an exterior **120** of the bottom section **110**. In relation to the center tube **160** that may also be comprised of quartz glass, as shown in FIG. **1**, the housing **182** of the top section **180** and the housing **152** of the middle section **150** may each feature an inside diameter that is larger than the outside diameter of the center tube **160**. As such, the center tube **160** may be disposed within the housing **152** of the middle section **150**, as illustrated in FIG. **1**. In addition, as further shown in FIG. **1**, the tank **155** may reside between the interior of the housing **152** of the middle section **150** and the exterior surface of the center tube **160**. Accordingly, the perspective view of FIG. **1** illustrates the tank **155** on either side of the center tube **160** that extends through the tank **155**.

Referring again to FIG. **1**, the exterior **120** of the bottom section **110** may be comprised of a metallic material. As further shown in FIG. **1**, the bottom section **110** may feature a seal **135**, which may be a silicone O-ring seal. Further, the bottom section **110** may also feature an air hole **138** to provide air flow. The metallic portions of the adjustable airflow cartridge **100** may comprise a ceramic coating featuring a range of thickness of 1-2 microns. The range of thickness of the ceramic coating may be larger than 1-2 microns, or it may be smaller than 1-2 microns. The ceramic coating may provide protection against heavy metals within the components of the adjustable airflow cartridge **100** from absorbing into the vapors during vaporization of liquids and oils within the adjustable airflow cartridge **100**. The ceramic coating may also comprise a zirconium nitride coating. In an embodiment, the metal components of the adjustable airflow cartridge **100** may be exclusively coated in a layer of zirconium nitride.

Referring again to the bottom section **110** of the adjustable airflow cartridge **100** shown in FIG. **1**, a portion **125** of the bottom section **110** may feature an adjustable air flow collar **130** comprising one or more adjustable intake air apertures **105**, where such portion **125** may be twisted or rotated by a user to adjust the amount of airflow through the one or more adjustable intake air apertures **105**. As a user rotates or twists the portion **125** of the bottom section **110** featuring the adjustable air flow collar **130** having the one or more adjustable intake air apertures **105**, a user may adjust the size of the one or more adjustable intake air apertures **105** to determine an amount of air passing through the one or more adjustable intake air apertures **105**. As a user draws air through the mouthpiece **185**, air may travel through the one or more adjustable intake air apertures **105**, through the atomizer and vape oil, through the center tube **160** of the middle section **150**, and to the mouthpiece **185** of the top section **180** of the adjustable airflow cartridge **100**. By controlling and determining the level of airflow through the one or more adjustable intake air apertures **105** of the bottom section **110**, a user can customize an experience with an electronic vaporizer.

FIG. **2** shows an adjustable airflow cartridge **200** with a housing **182** at a top section **180** comprising a mouthpiece **185** with opening **187**, where the housing **182** may be comprised of quartz glass. The housing **182** of the top section **180** may extend to and adjoin the housing **152** of the middle section **150**. The middle section **150** may include a tank **155** for maintaining a liquid or vape oil. Within the middle section **150**, a center tube **160** that may be made of quartz glass may extend through the tank **155** to provide an airway extending from the mouthpiece **185** to a bottom section **110** of the adjustable airflow cartridge **200**. Because the center tube **160** may extend through the tank **155** of the middle section **150**, the perspective view of FIG. **2** illustrates the tank **155** on either side of the center tube **160** that extends through the tank **155**. In an embodiment, based on a quartz-glass composition of the mouthpiece **185**, tank **155**, center tube **160**, and housings **182**, **152**, metal elements do not contact the liquid or vape oil within the adjustable airflow cartridge **200**.

Referring again to FIG. **2**, the bottom section **110** of the adjustable airflow cartridge **200** may feature an exterior **120** that may be metallic that adjoins the housing **152** of the middle section **150**. As further shown in FIG. **2**, the bottom section **110** may feature a seal **135**, which may be a silicone O-ring seal. The metallic portions of the adjustable airflow cartridge **200** may comprise a ceramic coating featuring a range of thickness of 1-2 microns. As aforementioned, the range of thickness of the ceramic coating may be larger than 1-2 microns, or it may be smaller than 1-2 microns. The ceramic coating of the embodiments of FIG. **2** may also comprise a zirconium nitride coating. In another embodiment, the metal components of the adjustable airflow cartridge **200** may be exclusively coated in a layer of zirconium nitride.

As further illustrated in FIG. **2**, the bottom section **110** may also include 510 threading **115** for screwing the adjustable airflow cartridge **200** into a battery. The interior of the bottom section **110** may further comprise a ceramic protector **230** for protecting the heating element **220**. It should be noted that the ceramic protector may be made out of any material suitable for protecting ceramic, such as cotton. In addition, the heating element **220** may be seated on a sleeve **260**, which may be a metal sleeve, and an airway **215** may pass through the heating element **220**. The heating element **220** may feature a ceramic material, such as a porous ceramic material, and a coil **250** embedded in the ceramic material. The embedded coil **250** may be comprised of a heat resistant wire, such as a Kanthal® wire. Due to the ceramic heating chamber structure, the adjustable airflow cartridge

200 does not contain heavy metals that may contact the liquid or vape oil within the adjustable airflow cartridge **200**.

In addition, the ceramic heating chamber structure of the adjustable airflow cartridge **200** shown in FIG. **2** may increase the surface area of the porous ceramic material of the heating element **220**, thereby contributing to an enhanced vape experience and flavor of the vapor production. The enhanced surface area of the porous ceramic material of the ceramic heating element **220** in the adjustable airflow cartridge **200** may also provide for faster heating of the liquids and vape oils within the adjustable airflow cartridge **200**, enhanced vapor volume and improved taste for the user. The ceramic protector **230** and heating element **220** with porous ceramic material may also accommodate the properties of the liquids and vape oils within the adjustable airflow cartridge **200**, so that the cartridge is suitable for CBD/THC or essential oil quantities.

Referring again to FIG. **2**, a portion **125** of the bottom section **110** of the adjustable airflow cartridge **200** may also feature an adjustable air flow collar **130** comprising one or more adjustable intake air apertures, where such portion **125** may be twisted or rotated by a user to adjust the amount of airflow through the one or more adjustable intake air apertures. In particular, as a user rotates or twists the portion **125** of the bottom section **110** featuring the adjustable air flow collar **130** with one or more adjustable intake air apertures, air may travel through the air apertures, through the heating element **220** and vape oil, through the center tube **160** of the middle section **150**, and to the mouthpiece **185** of the top section **180** of the adjustable airflow cartridge **200**. By controlling and determining the level of airflow through the one or more adjustable intake air apertures of the bottom section **110**, a user can customize an experience with an electronic vaporizer.

The adjustable air flow collar **130** shown in the embodiment of FIG. **2** may provide for the ability to adjust the airflow capacity in the adjustable airflow cartridge **200**, based upon each draw upon the mouthpiece **185** by a user. For example, to close the adjustable air flow collar **130**, a user may twist or rotate the adjustable air flow collar **130** including the one or more adjustable intake air apertures to decrease the airflow through the one or more adjustable intake air apertures. By closing the adjustable air flow collar **130**, a user may thereby reduce the airflow to conserve a liquid or oil within the tank **155** of the adjustable airflow cartridge **200** and to reduce vapor production through the mouthpiece **185**. Conversely, to open the adjustable air flow collar **130**, a user may twist or rotate the adjustable air flow collar **130** including the one or more adjustable intake air apertures to increase the airflow through the one or more adjustable intake air apertures. By opening the adjustable air flow collar **130**, a user may thereby increase the airflow to produce maximum airflow through the adjustable airflow cartridge **200** and to increase vapor production through the opening **187** of the mouthpiece **185**. The adjustable air flow collar **130** may enable a user to determine a preferred airflow in each draw upon the mouthpiece **185**, thereby providing the user enhanced control over a vaping experience. As further illustrated in FIG. **2**, the bottom section **110** of the adjustable airflow cartridge **200** may also feature a bearing element **210** that may facilitate rotation of an adjustable air flow collar **130** by a user.

FIG. **3** shows an exploded view of an example adjustable airflow cartridge **300** featuring an adjustable air flow collar **130** comprising one or more adjustable intake air apertures **105** in a bottom section **110** of the herein described embodiments. Although FIG. **3** shows one adjustable intake air aperture **105** in the adjustable air flow collar **130** of the bottom section **110**, those of skill in the art would understand that an adjustable airflow cartridge **300** of the herein described embodiments may comprise one or more adjustable intake air apertures **105** in an adjustable air flow collar **130** of the bottom section **110**.

The exploded view of FIG. **3** illustrates an exterior **120** of the bottom section **110**, which houses the heating element **220** with embedded coil **250** that may be comprised of a heat resistant wire, such as a Kanthal® wire. The heating element **220** may be comprised of a ceramic material, such as a porous ceramic material. As illustrated in the exploded view of FIG. **3**, the embedded coil **250** is shown apart from the heating element **220**, but it is understood that when the cartridge **300** is assembled for use, the embedded coil **250** is embedded within the porous ceramic material of the ceramic heating element **220**. The bottom section **110** comprising the heating element **220** with embedded coil **250** may enable the adjustable airflow cartridge **300** to vaporize liquids and oils at lower temperatures to provide for enhanced flavor and a cleaner tasting terpene profile of the liquids and oils.

In addition, FIG. **3** illustrates how the exterior **120** of the bottom section **110** of the adjustable airflow cartridge **300** may adjoin the housing **152** of the middle section **150** of an electronic vaporizer assembly. In an embodiment, the exterior **120** of the bottom section **110** may be metallic, and the respective housings **152**, **182** of the middle **150** and top **180** sections may be made of quartz glass.

As further illustrated in FIG. **3**, the middle section **150** of the adjustable airflow cartridge **300** may also feature a tank **155** for maintaining a liquid or vape oil. Within the middle section **150**, a center tube **160** that may be made of quartz glass may pass through the tank **155** to provide an airway extending from the bottom section **110** of the adjustable airflow cartridge **300** to a mouthpiece **185** at a top section **180** of the adjustable airflow cartridge **300**. In an embodiment, a quartz-glass composition of the mouthpiece **185**, tank **155**, center tube **160**, and housings **182**, **152** may enable the adjustable airflow cartridge **300** to eliminate contact between metal elements and the liquid or vape oil within the adjustable airflow cartridge **300**.

As depicted in FIG. **3**, the housing **182** of the top section **180** may extend to and adjoin the housing **152** of the middle section **150**. In addition, the housing **152** of the middle section **150** may extend to and adjoin an exterior **120** of the bottom section **110**. The exterior **120** of the bottom section **110** may include 510 threading **115** for screwing the adjustable airflow cartridge **300** into a battery. As further shown in FIG. **3**, the bottom section **110** may feature an air hole **138** to provide air flow. The exterior **120** of the bottom section **110** may also be metallic, where the metallic portions of the adjustable airflow cartridge **300** may comprise a ceramic coating featuring a range of thickness of 1-2 microns. As aforementioned, the range of thickness of the ceramic coating may be larger than 1-2 microns, or it may be smaller than 1-2 microns. The ceramic coating of the embodiments of FIG. **3** may also comprise a zirconium nitride coating. In another embodiment, the metal components of the adjustable airflow cartridge **300** may be exclusively coated in a layer of zirconium nitride.

Referring again to FIG. **3**, the structure of the heating element **220** with porous ceramic material may create a larger surface area of a porous ceramic material, thereby contributing to an enhanced taste and flavor for the user during vaping. In addition, by rotating or twisting a portion **125** of the bottom section **110** featuring an adjustable air flow collar **130** comprising at least one or more adjustable

intake air apertures **105**, a user may customize the flavor and vapor production when using the adjustable airflow cartridge **300** of the herein described embodiments.

The embodiment of FIG. **4** shows a cross-sectional view of an adjustable airflow cartridge **400** with a bottom section **110** having a metallic exterior **120** and middle section **150** featuring a quartz-glass housing **152**. As shown in FIG. **4**, the bottom section **110** may feature a seal **135**, which may be a food grade silicone O-ring seal. An interior of the bottom section **110** may also include a heating element **220**. The heating element **220** may feature a ceramic material, such as a porous ceramic material, and an embedded coil **250**, where the embedded coil **250** may be comprised of a heat resistant wire, such as a Kanthal® wire embedded in the ceramic material. The heating element **220** may be seated on a sleeve **260**, which may be a metal sleeve, and an airway **215** may pass through the heating element **220**. In addition, the heating element **220** may further include a ceramic protector **230** having an upper region **410** that may prevent dissipation of heat into the middle section **150** of the adjustable airflow cartridge **400**. In particular, the ceramic protector **230** surrounds the heating element **220** with embedded coil **250**. The ceramic protector **230** may provide protection for the oil or resin within the adjustable airflow cartridge **400** that is heated for vaping. In one embodiment, the ceramic protector **230** may be comprised of a hard ceramic material such as zirconium nitride.

The embodiment of FIG. **4** shows a ceramic protector **230** that shields the oil or resin, so that there is no contact between the radiant heat and the oil or resin, thereby protecting against absorbance trace hard metals into the oil or resin. The absence of contact between the radiant heat and the oil or resin also prevents "spit backs," which occur when a heated coil within the adjustable airflow cartridge **400** emits hot droplets of oil or resin toward the mouthpiece during vaping by a user. In the embodiment of FIG. **4**, the embedded coil **250** may be embedded and surrounded by a ceramic material, such as zirconium nitride, to prevent the oil or resin from heating too quickly, causing a "spit back."

Referring again to the embodiment of FIG. **4**, the structure of the adjustable airflow cartridge **400** may further include the middle section **150** with quartz glass housing **152** encasing a tank **155** for maintaining a liquid or vape oil. Within the middle section **150**, a center tube **160**, which may be comprised of quartz glass, may extend through the tank **155** to provide an airway extending from the bottom section **110** to a mouthpiece at a top section of the adjustable airflow cartridge **400**. Based on the quartz-glass composition of the mouthpiece of the top section and the whole tank **155** of the middle section **150**, including both the quartz glass housing **152** and quartz glass center tube **160**, metal elements do not contact the liquid or vape oil within the adjustable airflow cartridge **400**.

Although not shown in FIG. **4**, it is understood that the adjustable airflow cartridge **400** as shown in the embodiment of FIG. **4** may also feature a top section, as shown in FIGS. **1** through **3**, comprising a mouthpiece **185** with quartz-glass housing **182**. The quartz-glass housing of the top and middle sections **152**, **182** may extend and adjoin to the metallic exterior **120** of the bottom section **110**, where the metallic portions of the adjustable airflow cartridge **400** may comprise a ceramic coating featuring a range of thickness of 1-2 microns. As aforementioned, the range of thickness of the ceramic coating may be larger than 1-2 microns, or it may be smaller than 1-2 microns. The ceramic coating of the embodiments of FIG. **4** may also comprise a zirconium nitride coating. In another embodiment, the metal components of the adjustable airflow cartridge **400** may be exclusively coated in a layer of zirconium nitride.

The bottom section of the adjustable airflow cartridge **400** may further include 510 threading **115** for screwing the adjustable airflow cartridge **400** into a battery, along with a portion **125** featuring an adjustable air flow collar **130** comprising one or more adjustable intake air apertures, where such portion **125** may be twisted or rotated by a user to adjust the amount of airflow through the one or more adjustable intake air apertures. More specifically, as a user rotates or twists the portion **125** of the bottom section **110** featuring an adjustable air flow collar **130** comprising one or more adjustable intake air apertures, a user may adjust the size of the one or more adjustable intake air apertures to determine an amount of air passing through the one or more adjustable intake air apertures. At a point when a user draws air through the mouthpiece **185** (see FIGS. **1** through **3**), air may travel through the one or more adjustable intake air apertures, through the atomizer and vape oil, through the quartz glass center tube **160** of the middle section **150**, and to the mouthpiece **185** of the top section **180** of the adjustable airflow cartridge **400**. By controlling and determining the level of airflow through the one or more adjustable intake air apertures of the bottom section **110**, a user can customize an experience with an electronic vaporizer. As further illustrated in FIG. **4**, the bottom section **110** of the adjustable airflow cartridge **200** may also feature a bearing element **210** that may facilitate rotation of an adjustable air flow collar **130** by a user.

Referring to FIG. **5**, an adjustable airflow cartridge **500** of the herein described embodiments is shown that is coupled to a vaporizer pen **190**. The vaporizer pen **190** comprises a housing **195** that encases a battery **197**. The adjustable airflow cartridge **500**, with top section **180**, middle section **150**, and bottom section **110**, may couple to the vaporizer pen **190** at an attachment point **193** by screwing the adjustable airflow cartridge **500** into the battery **197** with 510 threading disposed on the bottom section **110** of the adjustable airflow cartridge **500**.

In the adjustable airflow cartridges of the herein descried embodiments, it is understood that a portion of the bottom section **110** of the adjustable airflow cartridge may feature an adjustable air flow collar **130** comprising one or more adjustable intake air apertures **105**. The size of such one or more adjustable intake air apertures **105** may be adjusted by a user by rotating or twisting the portion **125** of the bottom section **110** featuring the adjustable air flow collar **130** comprising the one more adjustable intake air apertures **105**. When rotating or twisting the portion **125** of the bottom section **110** featuring the adjustable air flow collar **130** having the one or more adjustable intake air apertures **105**, a user may thereby adjust the size of the one or more air apertures **105**. In addition, the one or more adjustable intake air apertures **105** may be adjusted reciprocally between larger apertures **105** providing increased airflow and smaller apertures **105** providing decreased airflow. The one or more adjustable intake air apertures **105** of the herein described embodiments of the adjustable airflow cartridge may enable a user to determine the passage of the airflow through the one or more adjustable intake air apertures **105**, through the heating element **220** and vape oil, through the center tube **160** of the middle section **150**, and through the mouthpiece **185** of the top section **180** of the cartridge. By determining the airflow, a user may control the resulting vapor production and vapor flavor produced by an electronic vaporizer. The adjustable airflow cartridge of the herein described embodiments may provide flexibility and customizability by

enabling a user to selectively determine a desired airflow, based upon the ability to reciprocally adjust between sizes of the one or more adjustable intake air apertures **105** within the housing **120** of the bottom section **110** of the cartridge.

It is further understood that additional embodiments of the adjustable airflow cartridge may enable a user to adjust the size of the one or more adjustable intake air apertures **105**. For example, in one embodiment, a cartridge may feature a slidable collar that a user may slide up and down the exterior housings **120**, **152** of the cartridge to increase or decrease the size of the adjustable intake air apertures **105**. In another embodiment, the cartridge may feature a lever that rotates a cover for the adjustable intake air apertures **105**, thereby increasing or decreasing the size of the one or more adjustable intake air apertures **105**.

It is further understood that each of the metal components of the adjustable airflow cartridge of the embodiments described herein may be coated with a particular ceramic, such as zirconium nitride to coat and cover the metal components of the cartridge with a material that prevents transmission of metal elements to the vapors inhaled by the user. Such components are not limited to a mouthpiece of a vaporizer, the top, middle and bottom sections of an adjustable airflow cartridge, and the various component sub-parts that may comprise such portions of a vaporizer and adjustable airflow cartridge.

Although features and elements are described above in particular combinations, each feature or element can be used alone without the other features and elements or in various combinations with or without other features and elements.

What is claimed is:

1. An adjustable airflow cartridge for vaporizing liquids comprising:

a monolithic quartz glass housing comprising:

a quartz glass mouthpiece;

a quartz glass tank that includes a quartz glass center tube extending from the mouthpiece through the quartz glass tank, the mouthpiece, tank and center tube each stationary within the housing;

a bottom section including a metallic housing containing a heating element;

a silicon sealing element in contact with a bottom end of the quartz glass center tube and a bottom end of the quartz glass tank and that separates the quartz glass tank from the bottom section and heating element;

at least one adjustable air intake aperture, and

a rotatable portion that when rotated is configured to increase or decrease a size of the at least one adjustable air intake aperture,

wherein an amount of air flows through the adjustable airflow cartridge from the bottom section to the quartz glass mouthpiece by flowing through the at least one adjustable air intake aperture, through the heating element, and through the quartz glass center tube to the quartz glass mouthpiece,

wherein the amount of air flowing through the at least one adjustable air intake aperture may be adjusted based upon a rotation of the rotatable portion.

2. The adjustable airflow cartridge of claim **1**, wherein the bottom section further comprises a threaded portion configured to couple the cartridge to a battery.

3. The adjustable airflow cartridge of claim **1**, wherein the heating element further comprises a porous ceramic material.

4. The adjustable airflow cartridge of claim **1**, wherein the heating element further comprises a ferritic iron-chromium-aluminum (FeCrAl) alloy wire embedded in a porous ceramic material.

5. A detachable electronic vaporizer cartridge for vaporizing liquids comprising:

a monolithic quartz glass housing comprising:

a quartz glass mouthpiece;

a quartz glass tank that includes a quartz glass center tube extending from the mouthpiece through the quartz glass tank, the mouthpiece, tank and center tube each stationary within the housing;

a bottom section comprising:

a metallic housing,

a heating element contained in the metallic housing,

at least two air intake apertures, and

a threaded portion, and

a silicon sealing element in contact with a bottom end of the quartz glass center tube and a bottom end of the quartz glass tank and that separates the quartz glass tank from the bottom section and heating element,

wherein an amount of air flows through the detachable electronic vaporizer cartridge from the bottom section to the quartz glass mouthpiece by flowing through the at least two air intake apertures, through the heating element, and through the quartz glass center tube to the quartz glass mouthpiece, and wherein the amount of air flowing through the cartridge is based on the size of the at least two air intake apertures.

6. The detachable electronic vaporizer cartridge of claim **5**, wherein the threaded portion is configured to couple the detachable electronic vaporizer cartridge to a battery.

7. The detachable electronic vaporizer cartridge of claim **5**, wherein the heating element further comprises a porous ceramic material.

8. The detachable electronic vaporizer cartridge of claim **5**, wherein the heating element further comprises aa ferritic iron-chromium-aluminum (FeCrAl) alloy wire embedded in a porous ceramic material.

9. The detachable electronic vaporizer of cartridge of claim **5**, wherein the bottom section further comprises as silicon O-ring seal that is configured to prevent oil from leaking out of the tank.

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